US011185969B2

(12) **United States Patent**
Hsieh et al.

(10) **Patent No.: US 11,185,969 B2**
(45) **Date of Patent: Nov. 30, 2021**

(54) **PNEUMATIC TOOL HAVING MOVABLE AIR TUBE**

(71) Applicants: **Chih-Kuan Hsieh**, Hemei Township, Changhua County (TW); **Ya-Chun Lai**, Taoyuan (TW)

(72) Inventors: **Chih-Kuan Hsieh**, Hemei Township, Changhua County (TW); **Ya-Chun Lai**, Taoyuan (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 93 days.

(21) Appl. No.: **16/595,558**

(22) Filed: **Oct. 8, 2019**

(65) **Prior Publication Data**

US 2021/0101271 A1 Apr. 8, 2021

(51) **Int. Cl.**

B25D 9/08	(2006.01)
B25D 9/04	(2006.01)
B25D 17/24	(2006.01)
B25D 17/04	(2006.01)

(52) **U.S. Cl.**

CPC ***B25D 9/08*** (2013.01); ***B25D 9/04*** (2013.01); ***B25D 17/046*** (2013.01); ***B25D 17/24*** (2013.01); *B25D 2250/181* (2013.01)

(58) **Field of Classification Search**

CPC B25D 9/08; B25D 9/04; B25D 17/046; B25D 17/24; B25D 2250/181

USPC 173/200, 169, 206

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,791,461	A *	2/1974	Rosselet	B25D 9/22 173/48
6,192,997	B1 *	2/2001	Tsai	B25D 9/18 173/162.1
9,844,867	B2 *	12/2017	Hsieh	B25D 9/08
2011/0232929	A1 *	9/2011	Chang	B25D 17/24 173/162.2

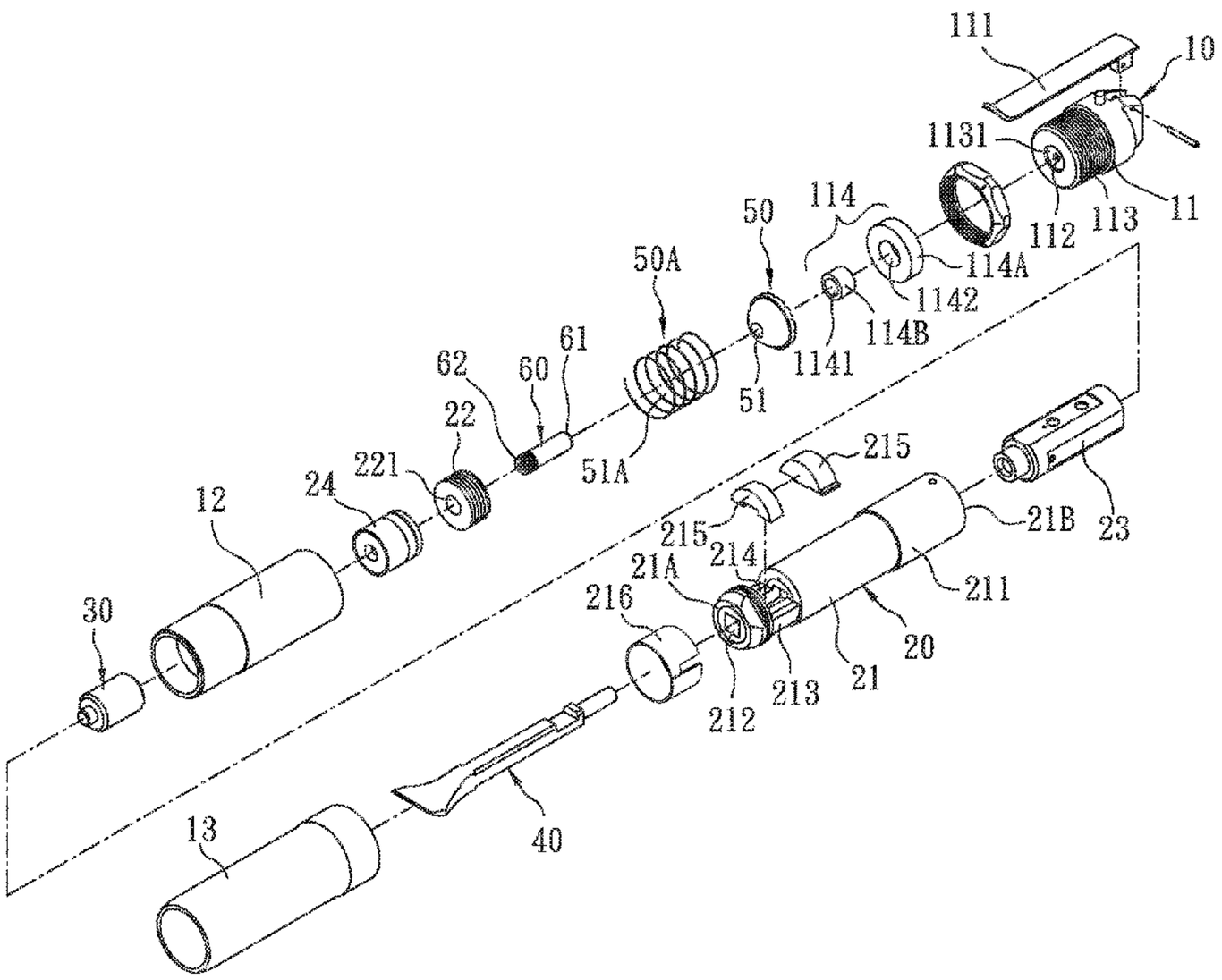
* cited by examiner

Primary Examiner — Anna K Kinsaul
Assistant Examiner — Luis G Del Valle
(74) *Attorney, Agent, or Firm* — Alan D. Kamrath; Karin L. Williams; Mayer & Williams PC

(57) **ABSTRACT**

A pneumatic tool contains: a body, a drive unit, a piston element, at least one buffer, and a movable air tube. The body includes an intake head, a limiting sleeve, a switch, an air conduit, and a connection portion. The connection portion has a first guide element, a first guiding orifice, and the limiting sleeve has a shoulder. The drive unit includes a moving tube, a first segment, and a second segment. The moving tube has a protrusion, the second segment has a second guide element and a second guiding orifice. The moving tube has a coupling orifice and a cavity, and an air valve is defined between the cavity and the second guide element. One buffer is defined between the first guide element and the second guide element and includes a first through hole. The movable air tube includes an air inlet segment and an air outlet segment.

9 Claims, 10 Drawing Sheets



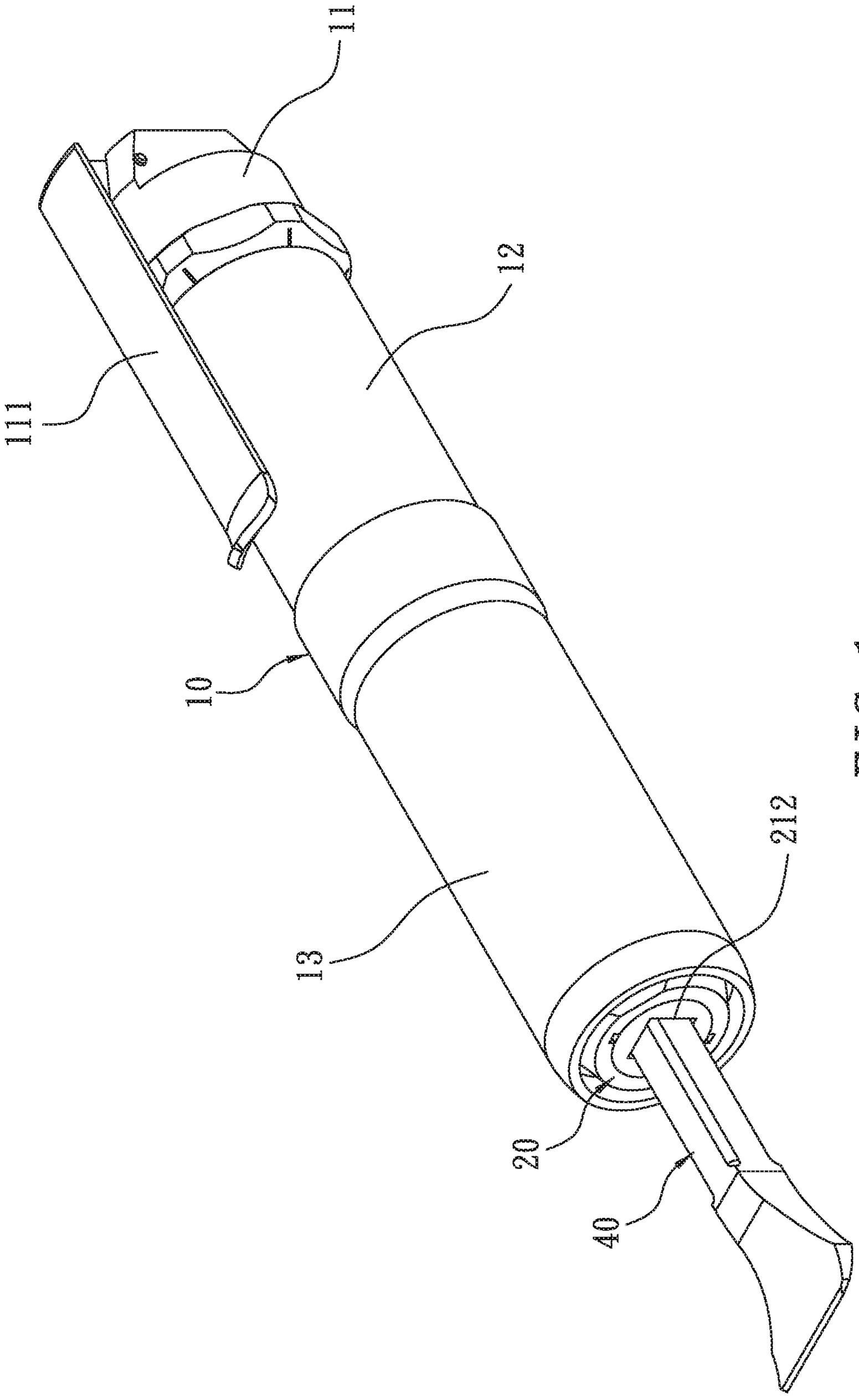


FIG. 1

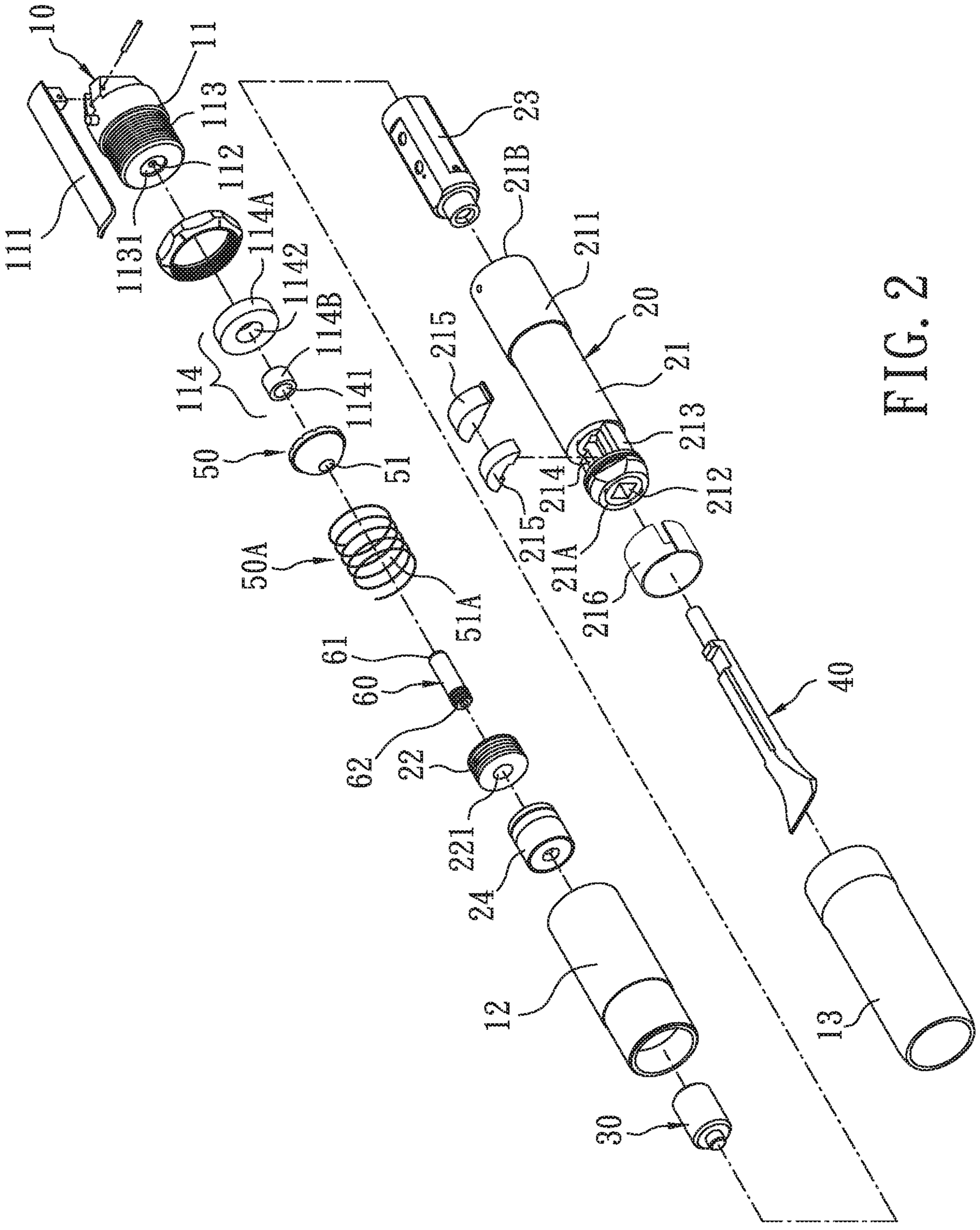

10
11
113
112
111
1131
114A
1142
114B
114
1141
50
51
50A
51A
61
60
62
22
221
24
12
30
23
21B
211
215
214
213
212
21A
216
20
21
40
13

FIG. 2

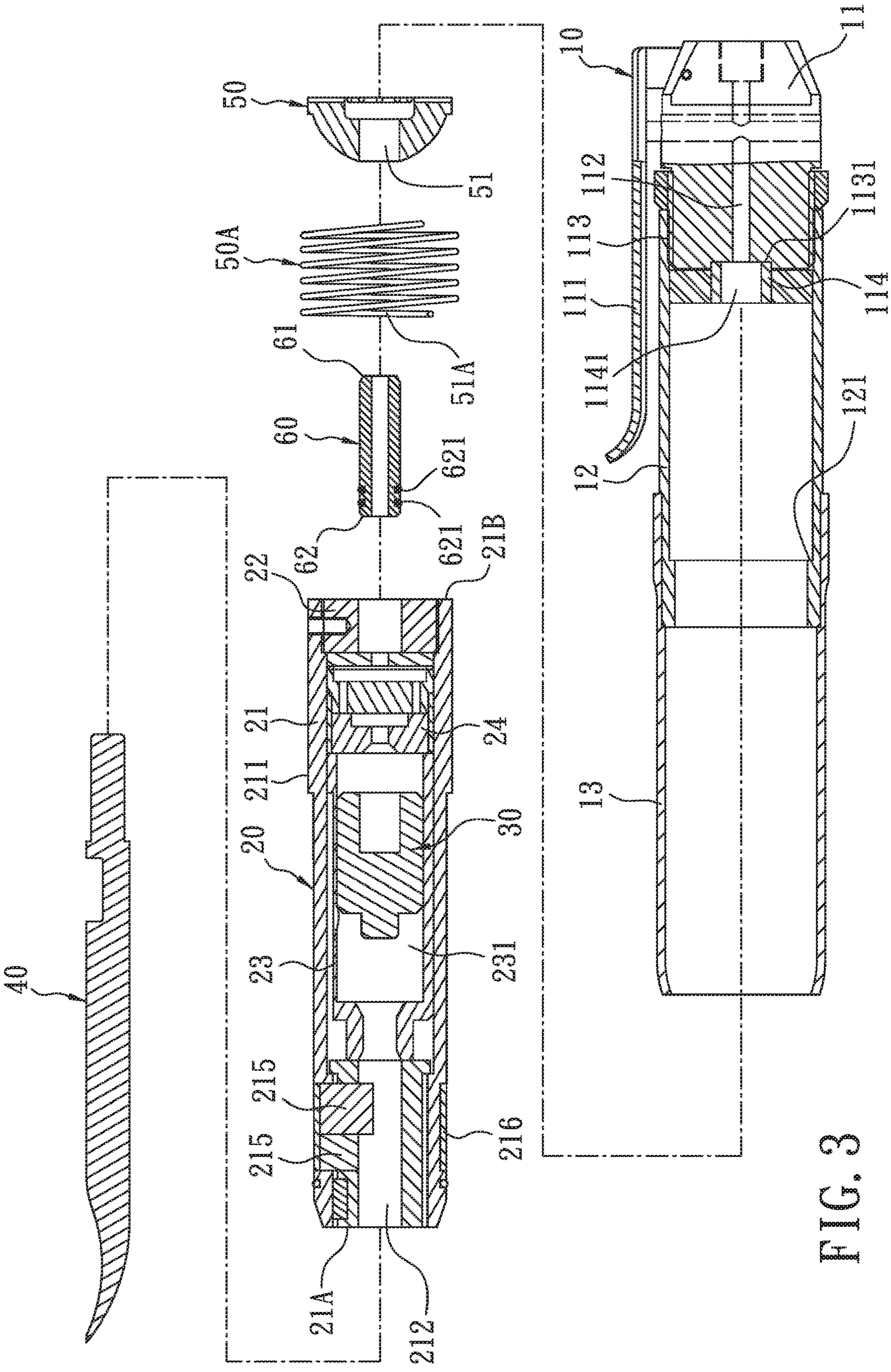

50
51
50A
51A
61
60
62
621
621
22
21B
21
211
24
20
30
23
231
215
215
216
21A
212
40
10
11
112
113
1131
111
114
1141
12
121
13

FIG. 3

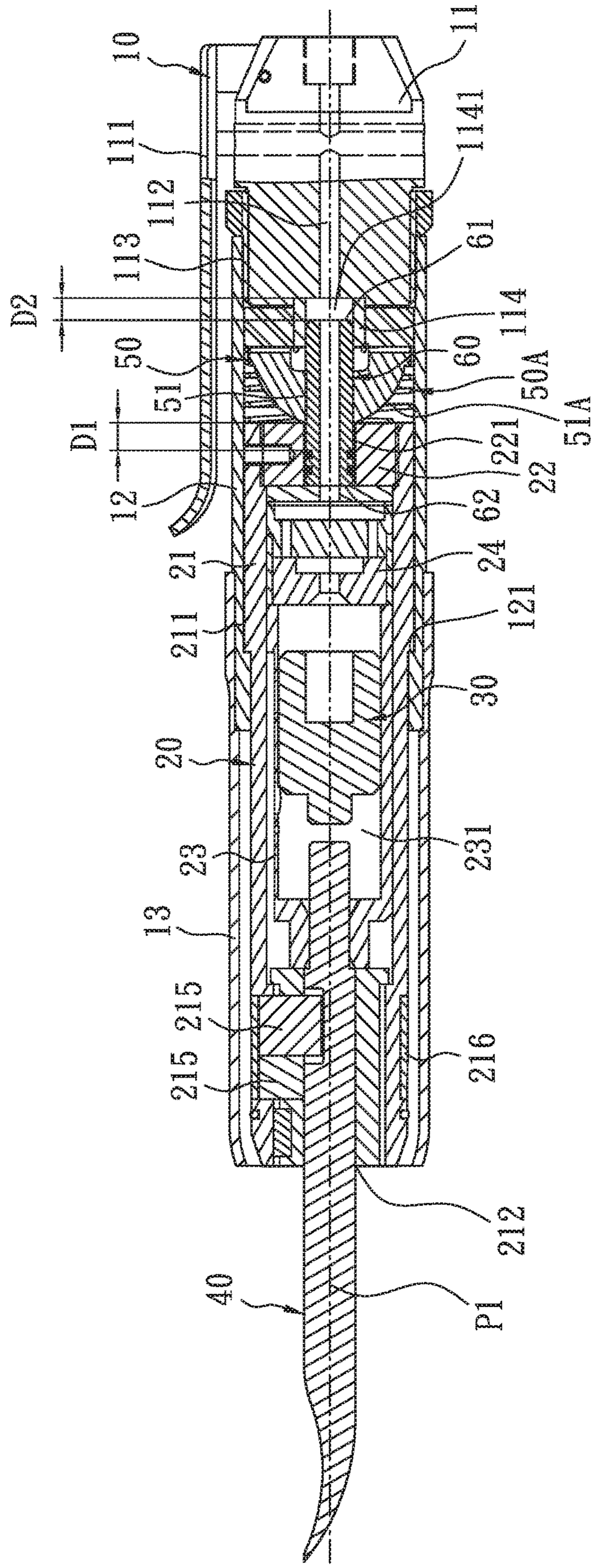

10
11
111
1141
112
113
61
D2
114
50
60
51
50A
D1
21
221
51A
12
22
62
24
21
121
211
30
20
231
23
13
215
215
216
212
40
P1

FIG. 4

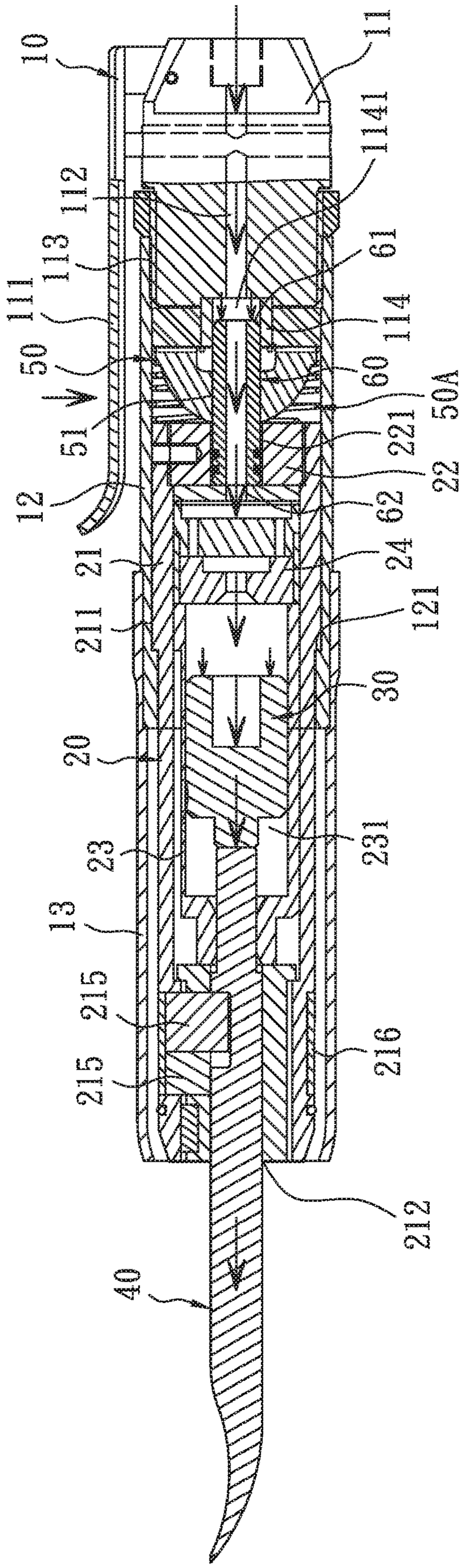

10
11
1141
112
113
61
111
114
50
60
51
50A
221
2
22
12
62
21
24
211
121
30
20
231
23
13
215
216
215
212
40

FIG. 5

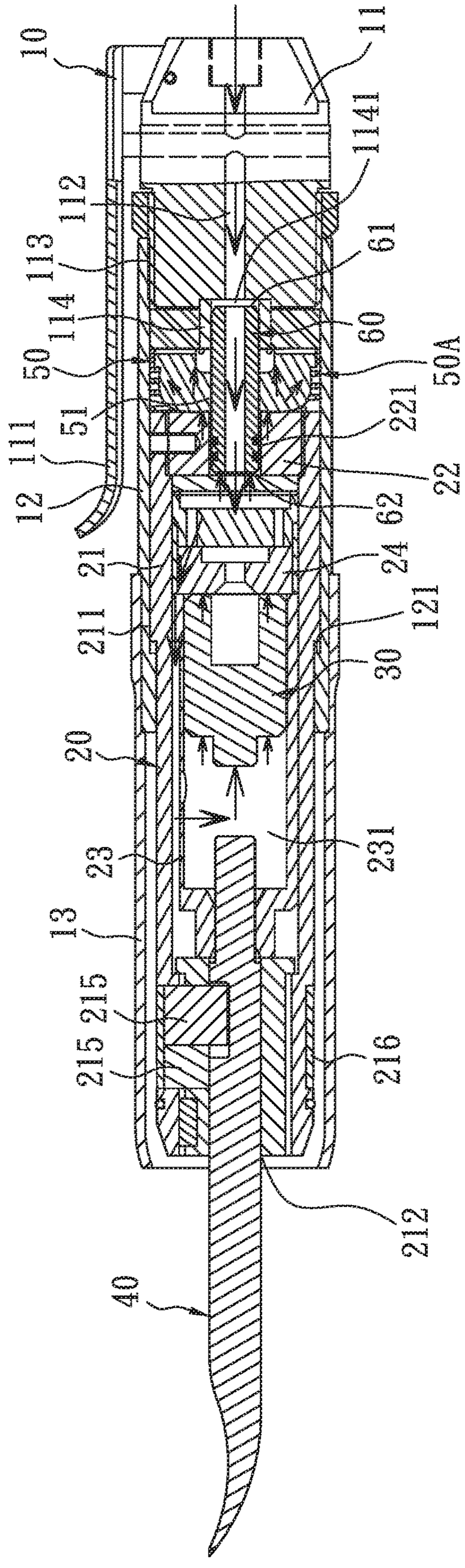

10
11
1141
112
113
61
114
60
50
50A
51
221
111
22
12
62
21
24
211
121
30
20
231
23
13
215
216
212
40

FIG. 6

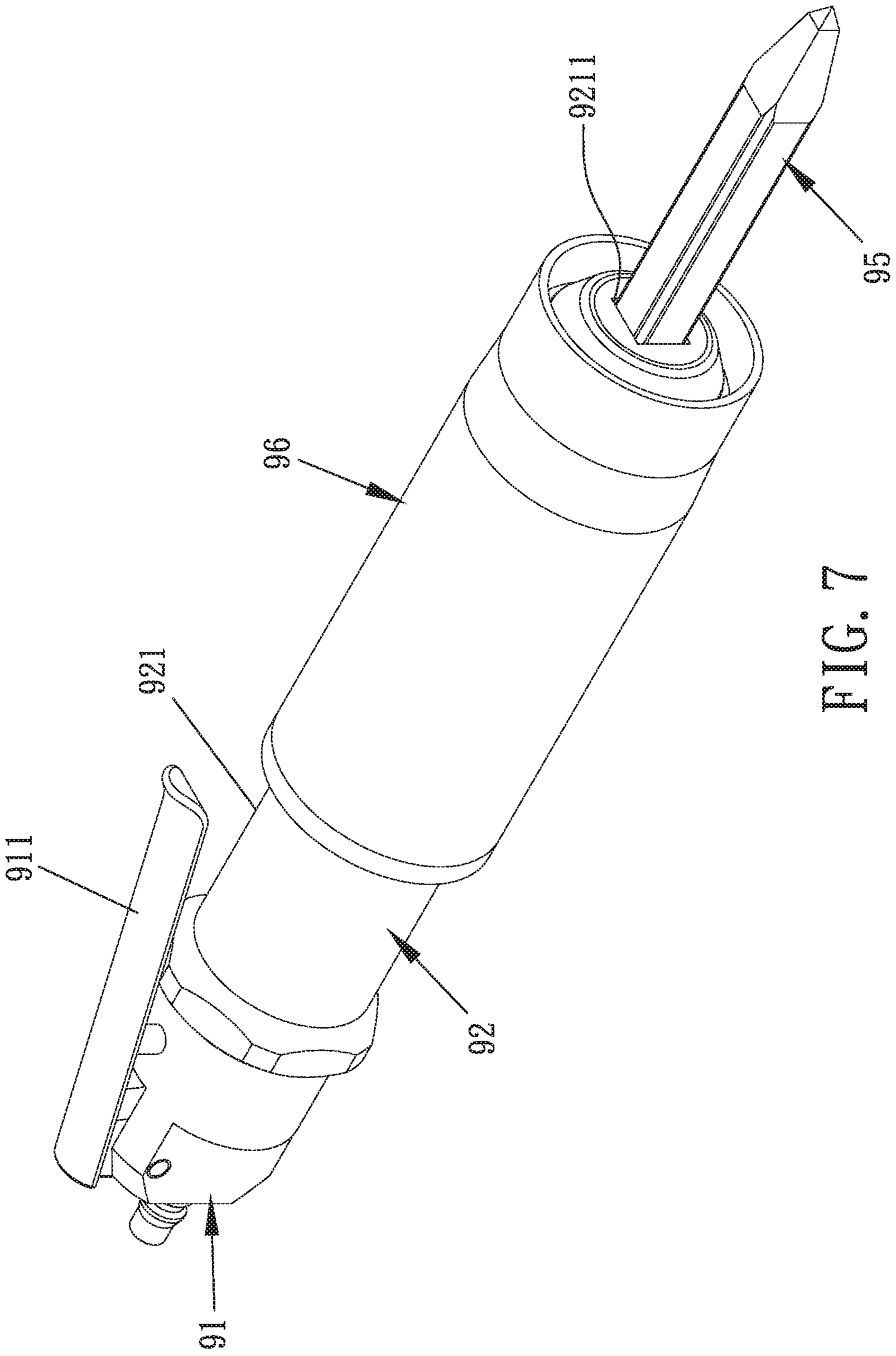


FIG. 7
PRIOR ART

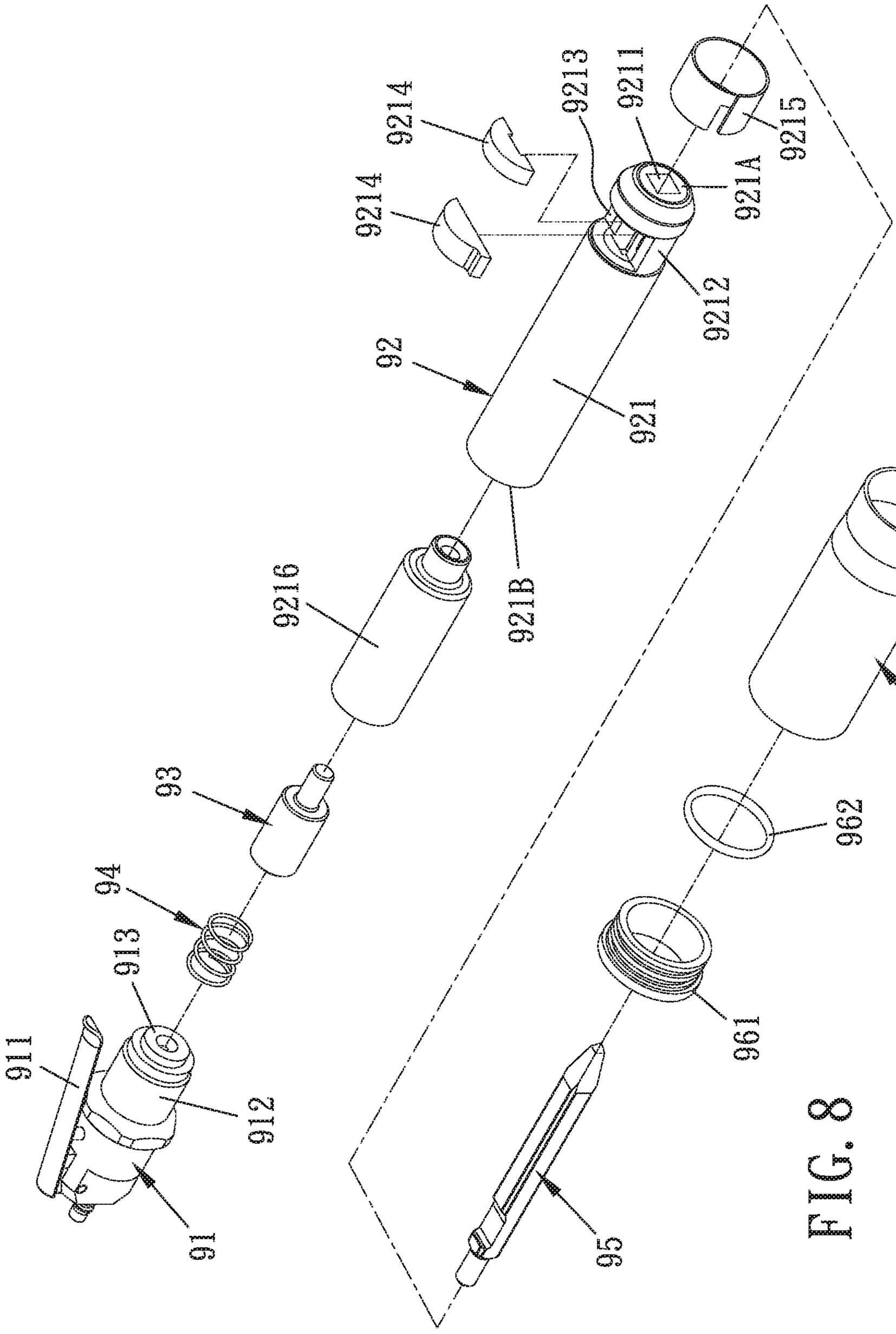


FIG. 8
PRIOR ART

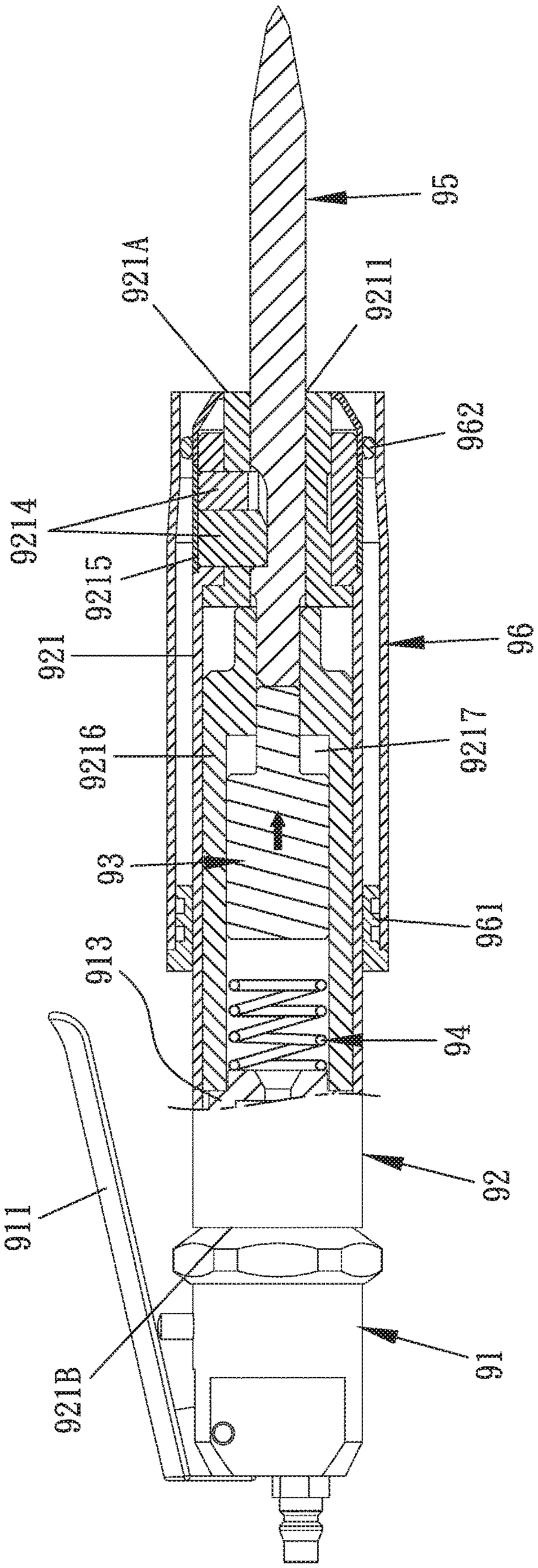


FIG. 9
PRIOR ART

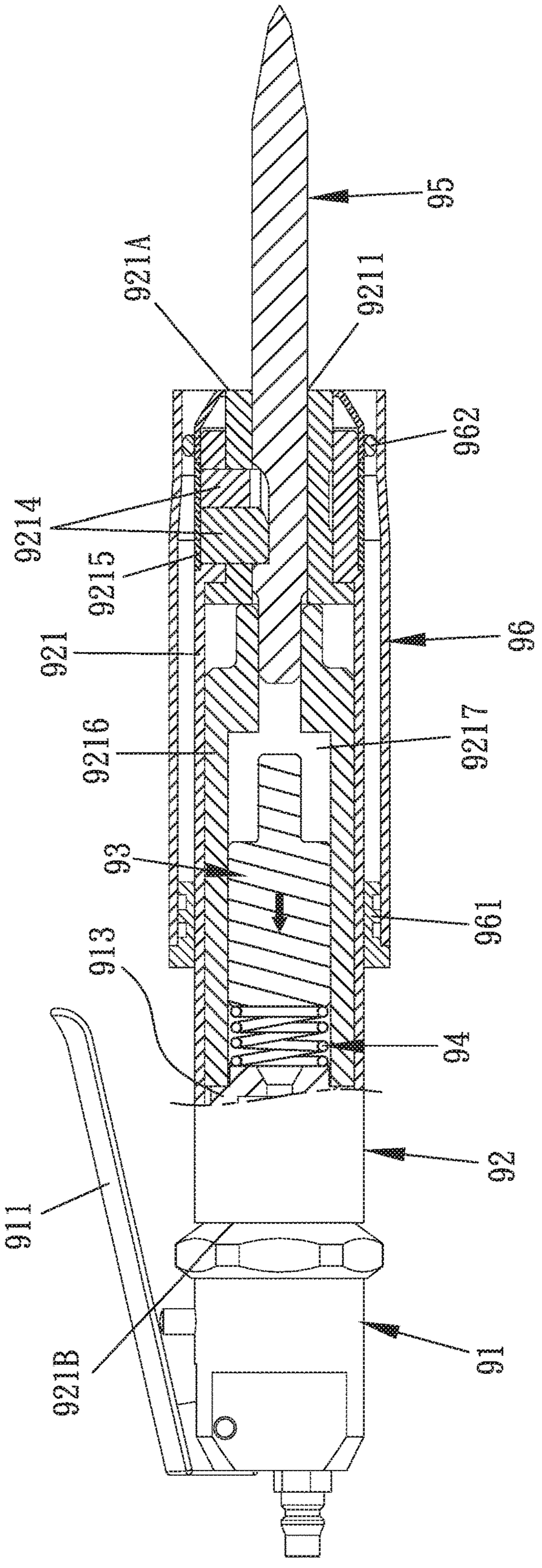


FIG. 10
PRIOR ART

PNEUMATIC TOOL HAVING MOVABLE AIR TUBE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a pneumatic tool, and more particularly to the pneumatic tool having a movable air tube.

Description of the Prior Art

A conventional pneumatic tool is driven by a power source from compressed air of an air compressor so that the compressed air pushes a piston element to strike a tool head forwards and backwards, hence the piston element provides energy to the tool head as striking the tool head, and the conventional pneumatic tool cuts, punches, descales, removes rust, and chisels a workpiece.

Referring to FIGS. **7-10**, a conventional pneumatic tool contains an intake head **91**, a drive unit **92**, a piston element **93**, a spring **94**, a tool head **95**, and a shockproof sleeve **96**.

The intake head **91** includes a switch **911** arranged on an outer wall thereof, a connection portion **912** fixed on an end of the intake head **91**, and an air valve **913** accommodated in the connection portion **912**. The drive unit **92** includes a fixed tube **921** which has a first segment **921**A and a second segment **921**B, wherein the second segment **921**B is connected with the connection portion **912** of the intake head **91**, the first segment **921**A has a coupling orifice **9211** defined on a center thereof, a fixing trench **9212** formed adjacent to the first segment **921**A, a cutout **9213** defined on the fixing trench **9212** and communicating with the coupling orifice **9211**, two defining blocks **9214** accommodated in the cutout **9213**, a restraining loop **9215** connected with the fixing trench **9212** so as to limit the two defining blocks **9214**, a cylinder **9216** received in the fixed tube **921**, a cavity **9217** formed in the cylinder **9216** and communicating with the coupling orifice **9211**. The piston element **93** is slidably accommodated in the cavity **9217**, and the spring **94** is received in the cavity **9217** and is defined between the piston element **93** and the air valve **913**. The tool head **95** is a chisel inserted into the coupling orifice **9211** of the fixed tube **921** so that the two defining blocks **9214** mate with the restraining loop **9215** to limit the tool head **95**. The shockproof sleeve **96** is fitted on an outer wall of the fixed tube **921** of the drive unit **92**, and a gap **A1** is defined between the shockproof sleeve **96** and the fixed tube **921** so as to receive two flexible elements **961**, **962**.

In use, the switch **911** is turned on so that high-pressure air flows into the first segment **921**A of the fixed tube **921** from the intake head **91** via the air valve **913**, such that the piston element **93** is pushed by the high-pressure air to strike the tool head **94**, then the high-pressure air pushes the piston element **93** to move toward the air valve **913** so as to press the spring **94** to strike the air valve **913**, thus pushing the piston element **93** forwards and backwards strikes the tool head **94** to chisel the workpiece.

Thus the spring **94** moves backward in the piston element **93** to strike the air valve **913** so as to reduce vibration and reaction force to a user's hand. The spring **94** is stroked directly by the piston element **93** to compress, but it cannot be protected and is damaged easily, thus replacing the spring **94** frequently and having using inconvenience and high using cost.

The present invention has arisen to mitigate and/or obviate the afore-described disadvantages.

SUMMARY OF THE INVENTION

The primary objective of the present invention is to provide a pneumatic tool having a movable air tube which when a piston element moves backward to strike an air valve, at least one buffer provide a buffering effect, and a movement travel of the movable air tube interfaces the buffering effect, such that a vibration of the pneumatic tool reduces effectively.

Another objective of the present invention is to provide a pneumatic tool having a movable air tube which a compression of the at least one buffer is limited by a movement travel of the movable air tube, thus protecting the at least one buffer, prolonging a service life of the at least one buffer, enhancing using convenience of the pneumatic tool, and reducing using cost.

To obtain above-mentioned aspects, a pneumatic tool having a movable air tube provided by the present invention contains: a body, a drive unit, a piston element, at least one buffer, and a movable air tube.

The body includes an intake head and a limiting sleeve, the intake head has a switch arranged on an outer wall of the intake head, an air conduit defined in the intake head, and a connection portion formed on an end of the intake head. The connection portion has a first guide element connected on an edge thereof, and the first guide element has a first guiding orifice, a first end of the limiting sleeve is connected with the connection portion of the intake head, and the limiting sleeve has a shoulder formed therein.

The drive unit includes a moving tube which has a first segment and a second segment, and the moving tube being slidably received in the limiting sleeve of the body. The moving tube has a protrusion formed on an outer wall thereof and stopped by the shoulder of the limiting sleeve so that the moving tube does not slide forward in the limiting sleeve, the second segment of the moving tube has a second guide element arranged therein, the second guide element has a second guiding orifice defined thereon, the moving tube has a coupling orifice defined on a center of the first segment thereof. The moving tube has a cavity communicating with the coupling orifice, and an air valve is defined between the cavity and the second guide element.

The piston element is slidably accommodated in the cavity of the drive unit.

The at least one buffer is flexible and is received in the limiting sleeve, one of the at least one buffer is defined between the first guide element and the second guide element, and the one buffer includes a first through hole defined on a center thereof.

The movable air tube is located on an axis with the air conduit and the piston element, the movable air tube is inserted into the first through hole of the one buffer and a second through hole of another buffer, and the movable air tube includes an air inlet segment and an air outlet segment. The air inlet segment is slidably inserted into the first guiding orifice of the first guide element, the air outlet segment is slidably inserted into the second guiding orifice of the second guide element so that the movable air tube slides along the axis forwards and backwards in a non-hand control manner, an outer wall of the air outlet segment of the movable air tube has at least one O-ring engaged thereon so that the at least one O-ring abuts against an inner wall of the second guiding orifice. When the air outlet segment of the movable air tube contacts with the air valve, a first distance

is defined among the at least one O-ring and the second guiding orifice adjacent to the intake head, and a second distance is defined between the air inlet segment and the first guiding orifice adjacent to the intake head, wherein the first distance is more than the second distance.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view showing the assembly of a pneumatic tool having a movable air tube according to a preferred embodiment of the present invention.

FIG. **2** is a perspective view showing the exploded components of the pneumatic tool having the movable air tube according to the preferred embodiment of the present invention.

FIG. **3** is a cross sectional view showing the exploded components of the pneumatic tool having the movable air tube according to the preferred embodiment of the present invention.

FIG. **4** is a cross sectional view showing the assembly of the pneumatic tool having the movable air tube according to the preferred embodiment of the present invention.

FIG. **5** is a cross sectional view showing the operation of the pneumatic tool having the movable air tube according to the preferred embodiment of the present invention.

FIG. **6** is another cross sectional view showing the operation of the pneumatic tool having the movable air tube according to the preferred embodiment of the present invention.

FIG. **7** is a perspective view showing the assembly of a conventional pneumatic tool.

FIG. **8** is a perspective view showing the exploded components of the conventional pneumatic tool.

FIG. **9** is a cross sectional view showing the operations of the conventional pneumatic tool.

FIG. **10** is another cross sectional view showing the operations of the conventional pneumatic tool.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will be clearer from the following description when viewed together with the accompanying drawings, which show, for purpose of illustrations only, a preferred embodiment in accordance with the present invention.

With reference to FIGS. **1-4**, a pneumatic tool having a movable air tube according to a preferred embodiment of the present invention comprises: a body **10**, a drive unit **20**, a piston element **30**, a tool head **40**, at least one buffer **50**, and the movable air tube **60**.

The body **10** includes an intake head **11**, a limiting sleeve **12**, and a shockproof sleeve **13**. The intake head **11** has a switch **111** arranged on an outer wall thereof, an air conduit **112** communicating in the intake head **11**, and a connection portion **113** formed on an end of the intake head **11**, wherein the connection portion **113** has a groove **1131** defined on an edge thereof and has a first guide element **114** connected on the edge of the connection portion **113**, and the first guide element **114** has a first guiding orifice **1141**. A first end of the limiting sleeve **12** is connected with the connection portion **113** of the intake head **11**, the limiting sleeve **12** includes a shoulder **121** formed therein, and the shockproof sleeve **13** is coupled with an end of the limiting sleeve **12** away from the intake head **11**. The first guide element **114** has a positioning ring **114**A and a bushing **114**B, wherein the positioning ring **114**A has a fitting orifice **1142** defined on a center thereof, the bushing **114**B is fitted with the fitting orifice **1142**, and an end of the bushing **114**B is inserted into the groove **1131** of the connection portion **113**, wherein the bushing **114**B has the first guiding orifice **1141** defined thereon.

The drive unit **20** includes a moving tube **21** which has a first segment **21**A and a second segment **21**B, and the moving tube **21** is slidably received in the limiting sleeve **12** and the shockproof sleeve **13**. The moving tube **21** has a protrusion **211** formed on an outer wall thereof and stopped by the shoulder **121** of the limiting sleeve **12** so that the moving tube **21** does not slide forward in the limiting sleeve **12**. The moving tube **21** has a coupling orifice **212** defined on a center of the first segment **21**A thereof, a fixing trench **213** formed adjacent to the first segment **21**A of the moving tube **21**, wherein the fixing trench **213** has a cutout **214** communicating with the coupling orifice **212** and accommodating two defining blocks **215**, and the fixing trench **213** is connected with a restraining loop **216** so as to fix the two defining blocks **215**. The second segment **21**B of the moving tube **21** has a second guide element **22** arranged therein, the second guide element **22** has a second guiding orifice **221** defined thereon, wherein the moving tube **21** accommodates a cylinder **23**, and the cylinder **23** has a cavity **231** communicating with the coupling orifice **212**, wherein an air valve **24** is defined between the cavity **231** and the second guide element **22**.

The piston element **30** is slidably accommodated in the cavity **231** of the drive unit **20**.

The tool head **40** is inserted into the coupling orifice **212** of the moving tube **21**, the two defining blocks **215** are connected with the cutout **214**, and the restraining loop **216** is fixed in the fixing trench **213** so that the tool head **20** is limited in the first segment **21**A of the moving tube **21**.

One of the at least one buffer **50** is flexible hemispherical and is received in the limiting sleeve **12**, wherein the one buffer **50** is defined between the first guide element **114** and the second guide element **22**, and the one buffer **50** includes a first through hole **51** defined on a center thereof. Another buffer **50**A is a spring and is fixed in the limiting sleeve **12**, and another buffer **50**A is defined between the first guide element **114** and the second guide element **22**. In addition, the other buffer **50** has a second through hole **51**A formed on a center thereof.

The movable air tube **60**, the air conduit **112**, and the piston element **30** are located on an axis P**1**, wherein the movable air tube **60** is inserted into the first through hole **51** of the one buffer **50** and the second through hole **51**A of another buffer **50**A. The movable air tube **60** includes an air inlet segment **61** and an air outlet segment **62**, wherein the air inlet segment **61** is slidably inserted into the first guiding orifice **1141** of the first guide element **114**, the air outlet segment **62** is slidably inserted into the second guiding orifice **221** of the second guide element **22** so that the movable air tube **60** slides along the axis P**1** forwards and backwards in a non-hand control manner. An outer wall of the air outlet segment **62** of the movable air tube **60** has at least one O-ring **621** engaged thereon (in this embodiment, two O-rings **621** are engaged on the outer wall of the air outlet segment **62** of the movable air tube **60**) so that the two O-rings **621** abut against an inner wall of the second guiding orifice **221**. When the air outlet segment **62** of the movable air tube **60** contacts with the air valve **24**, a first distance D**1** is defined among the two O-rings **621** and the second guiding orifice **221** adjacent to the intake head **11**, and a second distance D**2** is defined between the air inlet segment

61 and the first guiding orifice 1141 adjacent to the intake head 11, wherein the first distance D1 is more than the second distance D2.

In use, as shown in FIG. 5, the switch 111 of the body 10 is started so that high-pressure air flows into the air valve 24 from the air conduit 112 of the intake head 11 via the movable air tube 60 to be controlled by the air valve 24 and to enter into the cavity 231, and the high-pressure air flows to the first segment 21A of the moving tube 21 so as to push the piston element 30 to movably hit the tool head 40. Referring further to FIG. 6, the high-pressure air is controlled by the air valve 24 to urge the piston element 30 to move toward the second segment 21B of the moving tube 21 and to hit the air valve 24, such that the drive unit 20 is actuated to move to the intake head 11 and to force the one buffer 50 and another buffer 50A to compress, and the movable air tube 60 moves in the first guiding orifice 1141 and the second guiding orifice 221, Thereby, the one buffer 50 and another buffer 50A provide flexible buffering effect, and a movement travel of the movable air tube 60 interferes the buffering effect to absorb shock and to reduce a reaction force to user's hands, thus pushing the piston element 30 forwards and backwards.

Accordingly, the pneumatic tool of the present invention has advantages as follows:

1. The piston element 30 of the pneumatic tool moves to the second segment 21B of the moving tube 21 to strike the air valve 24, the piston element 30 actuates the drive unit 20 to move toward the intake head 11 so that the one buffer 50 and another buffer 50A are pressed by the drive unit 20, and the movable air tube 60 moves in the first guiding orifice 1141 and the second guiding orifice 221 so as to produce the buffering effect, wherein the movement travel of the movable air tube 60 interfaces the buffering effect, such that a vibration of the pneumatic tool reduces to protect the user's wrist and to operate the pneumatic tool easily.

2. The piston element 30 of the pneumatic tool moves to the second segment 21B of the moving tube 21 to strike the air valve 24, the piston element 30 actuates the drive unit 20 to move toward the intake head 11 so that the one buffer 50 is pressed by the drive unit 20, and the air outlet segment 62 of the movable air tube 60 contacts with the air valve 24, the air inlet segment 61 contacts with the intake head 11 so as to limit the compression of the one buffer 50 and another buffer 50A, thus protecting the one buffer 50 and another buffer 50A and prolonging a service life of the one buffer 50 and another buffer 50A.

While various embodiments in accordance with the present invention have been shown and described, it is clear to those skilled in the art that further embodiments may be made without departing from the scope of the present invention.

What is claimed is:

1. A pneumatic tool having a movable air tube comprising:

a body including an intake head and a limiting sleeve, the intake head having a switch arranged on an outer wall of the intake head, an air conduit defined in the intake head, and a connection portion formed on an end of the intake head, wherein the connection portion has a first guide element connected on an edge thereof, and the first guide element has a first guiding orifice, a first end of the limiting sleeve is connected with the connection portion of the intake head, and the limiting sleeve has a shoulder formed therein;

a drive unit including a moving tube which has a first segment and a second segment, and the moving tube being slidably received in the limiting sleeve of the body, wherein the moving tube has a protrusion formed on an outer wall thereof and stopped by the shoulder of the limiting sleeve so that the moving tube does not slide forward in the limiting sleeve, the second segment of the moving tube has a second guide element arranged therein, the second guide element has a second guiding orifice defined thereon, the moving tube has a coupling orifice defined on a center of the first segment thereof, the moving tube has a cavity communicating with the coupling orifice, wherein an air valve is defined between the cavity and the second guide element;

a piston element slidably accommodated in the cavity of the drive unit;

at least one buffer being flexible and being received in the limiting sleeve, wherein one of the at least one buffer is defined between the first guide element and the second guide element, and the one buffer includes a first through hole defined on a center thereof; and

a movable air tube located on an axis with the air conduit and the piston element, wherein the movable air tube is inserted into the first through hole of the one buffer and a second through hole of another buffer, the movable air tube includes an air inlet segment and an air outlet segment, wherein the air inlet segment is slidably inserted into the first guiding orifice of the first guide element, the air outlet segment is slidably inserted into the second guiding orifice of the second guide element so that the movable air tube slides along the axis forwards and backwards in a non-hand control manner, an outer wall of the air outlet segment of the movable air tube has at least one O-ring engaged thereon so that the at least one O-ring abuts against an inner wall of the second guiding orifice, when the air outlet segment of the movable air tube contacts with the air valve, a first distance is defined among the at least one O-ring and the second guiding orifice adjacent to the intake head, and a second distance is defined between the air inlet segment and the first guiding orifice adjacent to the intake head, wherein the first distance is more than the second distance.

2. The pneumatic tool as claimed in claim 1, wherein the first guide element has a positioning ring and a bushing, wherein the positioning ring has a fitting orifice defined on a center thereof, and the bushing is fitted with the fitting orifice, wherein the bushing has the first guiding orifice defined thereon.

3. The pneumatic tool as claimed in claim 2, wherein the connection portion of the intake head has a groove defined on an edge thereof, and an end of the bushing is inserted into the groove of the connection portion.

4. The pneumatic tool as claimed in claim 1, wherein the moving tube has a fixing trench formed adjacent to the first segment of the moving tube, wherein the fixing trench has a cutout communicating with the coupling orifice and accommodating two defining blocks, and the fixing trench is connected with a restraining loop so as to fix the two defining blocks.

5. The pneumatic tool as claimed in claim 1, wherein the moving tube accommodates a cylinder, and the cylinder has a cavity defined therein.

6. The pneumatic tool as claimed in claim 1, wherein one of the at least one buffer is flexible hemispherical.

7. The pneumatic tool as claimed in claim 1, wherein one of the at least one buffer is a spring.

8. The pneumatic tool as claimed in claim **1**, wherein the body includes a shockproof sleeve, the shockproof sleeve is coupled with an end of the limiting sleeve away from the intake head, and the moving tube is slidably received in the limiting sleeve and the shockproof sleeve of the body.

9. The pneumatic tool as claimed in claim **1** further comprising a tool head inserted into the coupling orifice of the moving tube.

* * * * *